

2. Remarks/Discussion of Issues

Claim Summary

Claim 1, 2, 3, 6, 14 and 17 have been amended to address informalities in the claim language and to more clearly define the invention.

Claims 1-11 and 13-17 remain pending in the application. Applicants respectfully submit that all pending claims are in condition for allowance.

Double Patenting

Claims 1, 3-6, 8 and 9 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1 and 5-10 of copending patent application no. 11/569,166 (U.S. Patent Application Publication No. 2008/0094389). *See Office Action, pp. 2-4.* Applicants respectfully disagree with respect to the Examiner's analysis of the pending claims.

Further, Applicants submit that a terminal disclaimer in the present application is premature. The present application is the earlier filed of the two pending applications, and U.S. Patent Application Publication No. 2008/0094389 apparently has not yet been acted on by the USPTO. Accordingly, the claims of the later filed application may be revised. Further, to the extent the nonstatutory obviousness-type double patenting provisional rejection may ultimately remain the only rejection in the present application, "the Examiner should withdraw that rejection and permit the earlier-filed application to issue as a patent without a terminal disclaimer." See MPEP § 804(I)(B)(1).

Rejection under 35 U.S.C. § 112, First Paragraph

In the Office Action, dated November 29, 2007, the Examiner rejected claim 17 under 35 U.S.C. § 112, first paragraph, as being failing to comply with the written description requirement. *See Office Action, p. 4.* Applicants respectfully traverse the rejection.

The standard for determining compliance with 35 U.S.C. § 112, first paragraph, is "does the description clearly allow persons of ordinary skill in the art to recognize that he or

she invented what is claimed.”” See MPEP § 2163.02 (quoting *In re Gosteli*, 872 F.2d 1008, 1012, 10 USPQ2d 1614, 1618 (Fed. Cir. 1989)). Significantly, “[t]he subject matter of the claim need not be described literally.” *Id.* In other words, a rejection under 35 U.S.C. § 112, first paragraph, is not appropriate where one of ordinary skill in the art would find adequate disclosure of the claimed subject matter in the written description.

With respect to claim 17, the Examiner asserts that there is inadequate written description to support a “computer readable medium for storing a computer program” See Office Action, p. 4. However, as acknowledged by the Examiner, the specification does provide a “computer program product having pre-programmed instructions to carry out the method” See para. [0070] (of corresponding published application US 2006/0098007). In addition, with respect to FIG. 9, the specification states that image data produced by apparatus 151 (e.g., a medical examination apparatus) “is fed to data processing means 153, such as a general-purpose computer, that carries out the steps of the method.” *Id.* (emphasis added). Applicants submit that the disclosure of a computer program product and a general purpose computer being fed imaging data for the purpose of performing the described imaging processing is sufficient for one of ordinary skill in the art to recognize that Applicants invented what is claimed. Specific types of media that store computer programs readable and executable by a general purpose computer, for example, are well known, particularly to one of ordinary skill in the art, and need not be “described literally” in the specification.

Accordingly, Applicants respectfully request withdrawal of the rejection of claim 17 under 35 U.S.C. § 112, first paragraph.

Rejection under 35 U.S.C. § 112, Second Paragraph

In the Office Action, dated November 29, 2007, the Examiner rejected claims 2, 11 and 14 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. See Office Action, p. 5.

Without admitting to the propriety of the Examiner's rejection, Applicants have amended claim 2, further to revisions of claim 1. Accordingly, the rejection under 35 U.S.C. § 112, second paragraph, with respect to claim 2 is moot.

With respect to claims 11 and 14, Applicants respectfully traverse the rejection. Claims 11 and 14 "define the patentable subject matter with a reasonable degree of particularity and distinctness," and thus should not be rejected under 35 U.S.C. § 112, second paragraph. *See MPEP § 2173.02* (emphasis added). In particular, Claim 11 recites an organ of the body "having substantially tubular parts" and claim 14 similarly recites "adapting a three-dimensional surface model of a substantially tubular object." One of ordinary skill in the art, particularly in light of the application disclosure (*see, e.g.*, FIGs. 3A, 3B, 4A, 4B, 6A, 6B, 7A, 7B and 8A-8D), would construe this claim language to mean that the "parts" and the "object" are generally tubular in shape, but may not be precisely or entirely tubular, for example. "Only when a claim remains insolubly ambiguous without a discernible meaning after all reasonable attempt at construction must a court declare it indefinite." *Id.* (quoting *Metabolite Labs., Inc. v. Lab. Corp. of Am. Holdings*, 3709 F.3d 1354, 1366, 71 USPQ2d 1081, 1089 (Fed. Cir. 2004)). Otherwise, "the terms should be permitted even though the claim language is not as precise as the examiner might desire." *Id.*

Accordingly, Applicants respectfully request withdrawal of the rejection of claims 11 and 14 under 35 U.S.C. § 112, second paragraph.

35 U.S.C. § 103

As stated in MPEP § 2143, in order to establish a *prima facie* case of obviousness under 35 U.S.C. § 103, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

Without conceding the propriety of the combination of references discussed below, Applicants respectfully submit that the obviousness rejections are improper for failing to meet

the ultimate requirement of § 2143. Further, Applicants' silence on certain aspects of the rejections is by no means a concession as to their propriety. Rather, because the applied art fails to disclose at least one feature of the claims, for at least the reasons discussed below, Applicants respectfully submit that the rejections are improper and should be withdrawn.

Rejections under 35 U.S.C. § 103 – Claims 1-3, 6, 10, 11 and 17

Claims 1-3, 6, 10, 11 and 17 are rejected under 35 U.S.C. § 103(a) as being unpatentable over et al. FLÓREZ-VALENCIA et al. ("3D Graphical Models for Vascular-Stent Pose Simulation") in view of HERNÁNDEZ-HOYOS et al. ("Computer-assisted Analysis of Three-dimensional MR Angiograms") in view of MONTAGNAT et al. ("A Hybrid Framework for Surface Registration and Deformable Models") and further in view of YIM et al. ("Vessel Surface Reconstruction with a Tubular Deformable Model"). Applicants respectfully traverse the rejections for at least the reasons set forth below.

Claim 1 features, inter alia:

"...creating a deformable tubular mesh model for fitting a 3-D path based on a centerline of a 3-D tubular object of interest, the 3-D path comprising a set of ordered points defining a plurality of path segments, the mesh model having an initial radius and comprising a plurality of mesh segments corresponding to the plurality of path segments; and automatically adapting a length of a mesh radius of each mesh segment based on a radius of local curvature of the corresponding path segment and the initial radius."

No proper combination of the applied references teaches or suggests at least these claim features.

The Office Action asserts that automatically adapting a mesh radius is taught by FLÓREZ-VALENCIA et al., p. 3, ¶3; p. 5, ¶3; p. 6, ¶1 and Figs. 2-4. See Office Action, p. 6. Referring to these cited portions, FLÓREZ-VALENCIA et al. generally discloses identifying a vessel centerline for a stent (e.g., Fig. 2), stacking contours orthogonal to the centerline (e.g., Figs. 2 and 3; p. 3, ¶2), mapping an initial straight model of the stent onto the vessel centerline (e.g., p. 3, ¶2), and creating a simplex mesh to represent the stent surface (e.g., p. 3, ¶3). However, there appears to be no teaching in FLÓREZ-VALENCIA et al. of automatically

adapting a length of the mesh radius of each mesh segment based on a radius of local curvature of a corresponding path segment and an initial radius of the mesh model. Rather, the cylindrical simplex model combines the mapped centerline and a radius r (e.g., p. 6, ¶3). The radius r does not appear to be adjusted along segments, and further, is not adjusted based on the parameters recited in claim 1.

The Office Action further quotes p. 4, ¶ 3 - p. 5, ¶ 1 of FLÓREZ-VALENCIA et al. (*see* Office Action, p. 6), stating: "When the surface undergoes some deformation, the centerline bends accordingly through an external force resulting from the surface forces" Generally speaking, this quote appears to refer to adjusting a center line based on changes in radius, i.e., deformation of the cylindrical surface, not adjusting a radius based, in part, on variations in a centerline, i.e., a radius of local curvature of a path segment from a 3-D path based on the centerline, as recited in claim 1. In fact, equation 2 of FLÓREZ-VALENCIA et al. computes deformation of the centerline of a virtual stent from external force f_{ext} .

The Office Action further quotes p. 5, ¶ 3 of FLÓREZ-VALENCIA et al. (*see* Office Action, p. 6), stating: "... r_k is the radius (means distance of the surface vertices to the centerline in a_k " Although r_k indicates a radius, it appears to be a variable used for determining a radial force f_{radial} on the surface of the virtual stent. Again, this does not teach adapting the radius, e.g., based on the radius of the local curvature of the corresponding path segment and the initial radius.

The Office Action additionally references YIM et al. to support the proposition that "radial lines are warped in areas where the vessel axis is curved (curvature of 3D path)." See Office Action p. 7. However, Applicants respectfully submit that warping radial lines does not teach or suggest adapting the length of the mesh radius, as recited in claim 1.

Accordingly, for at least the reasons set forth above, Applicant respectfully submit that the applied art fails to disclose at least one feature of claim 1. Thus a *prima facie* case of obviousness has not been established. Therefore, withdrawal of the rejection of claim 1 under 35 U.S.C. § 103(a) respectfully requested.

Applicants respectfully submit that independent claim 17 is allowable for at least substantially the same reasons as discussed above with respect to claim 1. Further, with

regard to claims 3, 6 and 10-11 (as well as newly submitted claim 13), Applicants assert that they are allowable at least because they depend, directly or indirectly, from independent claim 1, which Applicants submit has been shown to be allowable, and in view of their additional recitations of novelty.

Rejections under 35 U.S.C. § 103 – Claims 4, 5, 7-9, 14-16

In the Office Action, dated November 29, 2007, the Examiner rejected claims 4, 5 and 7-9 under 35 U.S.C. § 103(a) as being unpatentable over et al. FLÓREZ-VALENCIA et al., HERNÁNDEZ-HOYOS et al., MONTAGNAT et al. and YIM et al. in view of WILLIAMS et al. (“Rational Discrete Generalized Cylinders and their Application to Shape Recovery in Medical Images”). Applicants respectfully traverse the rejections for at least the reasons set forth below.

Independent claim 14 features, inter alia:

“...creating an initial straight deformable cylindrical mesh model having a length equal to a length of the three-dimensional path; dividing the initial mesh model into a plurality of mesh segments corresponding to the plurality path segments; computing a rigid-body transformation for each mesh segment for transforming an initial direction of each mesh segment into a path direction of the corresponding path segment; applying the rigid-body transformation for each mesh segment to corresponding vertices of the mesh segment; and adapting a mesh radius of each mesh segment based on at least a radius of curvature and a length of the corresponding path segment.”

No proper combination of the applied references teaches or suggests at least these claim features.

The Office Action asserts that claim 14 is rejected on the basis of “the rationale disclosed in the rejection of claims 1, 3 and 5.” See Office Action, p. 13. Applicants respectfully submit that independent claim 14 is allowable for at least substantially the same reasons as discussed above with respect to claim 1. For example, claim 14 recites adapting a mesh radius of each mesh segment based on at least a radius of curvature and a length of the

corresponding path segment, which is not taught or suggested by any proper combination of FLÓREZ-VALENCIA et al., HERNÁNDEZ-HOYOS et al., MONTAGNAT et al. and YIM et al.

The Office Action relies on WILLIAMS et al. only to teach using a linear interpolation between a family of rotations to limit self-intersection between twisted portions of a deformable tubular mesh model (with respect to claim 5), and therefore does not cure the deficiencies discussed above.

With regard to claims 4, 5, 7-9 and 15-16, Applicants assert that they are allowable at least because they depend, directly or indirectly, from independent claims 1 and 14, respectively, which Applicants submit have been shown to be allowable, and in view of their additional recitations of novelty.

CONCLUSION

No other issues remaining, reconsideration and favorable action upon the claims 1-11 and 13-17 now pending in the application are requested.

If any points remain in issue that may best be resolved through a personal or telephonic interview, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

Respectfully submitted on behalf of:
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